Laboratory Studies of Interstellar and Solar System Radiation Processing as a Source of Meteoritic Organic Molecules

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Of the organic molecules studied by exobiologists it is probably amino acids that receive the most attention because of the fundamental place they hold in the biochemistry. Glycine the the smallest amino acid and the most abundant one in meteorites and in living systems, was recently reported to be present in the gas-phase in the interstellar medium (1). We have shown that the presence and deuterium enrichment of glycine (and other amino acids) in meteorites is consistent with low temperature ice photochemistry (2). We will report on unpublished work on the mechanism of formation of glycine by UV photolysis of ices, and on spectroscopy (3) and photochemistry (4) of glycine and the putative precursor nitrile (aminoacetonitrile) under conditions resembling those in space.

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2) Bernstein, M. P., Dworkin, J. P., Sandford, S. A., Cooper, G. W., & Allamandola, L. J. (2002). Racemic amino acids from the ultraviolet photolysis of interstellar ice analogues. Nature 416, 401-403.
3) Bernstein, M. P., Bauschlicher C. W., & Sandford, S. A., (2004) The infrared spectrum of matrix isolated aminoacetonitrile, a precursor to the amino acid glycine Ad. Sp. Res., 33, 40-43.
4) Bernstein, M.P., Ashbourn, S. F. M., Sandford, S.A., and Allamandola, L. J. The Lifetimes of Nitriles (CN) and Acids (COOH) during Ultraviolet Photolysis and their Survival in Space, ApJ 601, 365-370, (2004)